REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 8, 14 and 18 have been amended. No new matter is being presented, and approval and entry are respectfully requested.

Claims 1-21 are pending and under consideration. Reconsideration is respectfully requested.

CHANGES TO THE SPECIFICATION:

In the Office Action, at page 2, numbered paragraph 1, the specification was objected to as failing to provide proper antecedent basis for "computer-readable medium" in claim 14. The specification has been reviewed in response to this Office Action. Changes have been made to the specification only to place it in preferred and better U.S. form for issuance and to resolve the Examiner's objections raised in the Office Action. No new matter has been added.

Claim 14 has been copied into the specification as a replacement paragraph for original paragraph [0064]. Original paragraph [0064] has been inserted as new paragraph [0065].

Hence, it is respectfully submitted that proper antecedent basis for "computer-readable medium" in claim 14 is in the specification, and the specification is in proper form.

CLAIM OBJECTIONS:

In the Office Action, at page 2, numbered paragraph 2, claims 8 and 14 were objected to because of formalities.

Claim 8, line 6, has been amended to change "setting contrast" to ---setting the contrast--- as suggested by the Examiner.

Claim 14, line 8, has been amended to change "setting a contrast" to ---setting the contrast--- as suggested by the Examiner.

Hence, it is respectfully submitted that claims 8 and 14 are now in allowable form.

REJECTION UNDER 35 U.S.C. §112:

In the Office Action, at page 3, numbered paragraph 4, claim 14 was rejected under 35 U.S.C. §112, first paragraph, for the reasons set forth therein. This rejection is traversed and reconsideration is requested.

Claim 14 has been copied into the specification as new paragraph [0064]. Hence, the claim limitation "computer-readable medium" in line 1 of claim 14 now contains a proper description in the specification of the disclosure.

Hence, claim 14 is submitted to be in allowable form under 35 U.S.C. §112, first paragraph.

REJECTION UNDER 35 U.S.C. §102:

A. In the Office Action, at pages 3-4, numbered paragraph 6, claims 1-3 were rejected under 35 U.S.C. §102(b) as being anticipated by Schu (US 2002/0136464; hereafter, Schu). This rejection is traversed and reconsideration is requested.

Schu teaches utilizing a mean value calculation as set forth in paragraphs [0037] through [0042] of Schu, reproduced below for the convenience of the Examiner:

> [0037] FIG. 1 illustrates a simplified block diagram of a circuit arrangement for realizing the method described above. An input image X to be processed is fed to a unit 1 for mean value calculation. This unit 1 determines the value x_m of the mean brightness of the input image X in accordance with an algorithm that will be described in more detail below. Furthermore, transformation function calculation units 2 and 3 are provided, which, as a function of the mean brightness value x_m and specific properties of the output image Y, determine the slope factors a_L and a_U, respectively (i.e., the transformation functions $f_L(x_{\cdot k})$ and $f_U(x_k)$, respectively) and communicate them to a mapper 4. The slope factors a_L and a_U are thus calculated from the output image Y, which corresponds to closed-loop control. In accordance with the transformation functions $f_L(x_k)$ and $f_U(x_k)$, an image processing unit or mapper 4 subjects the brightness values of the input image X and of the two sub-images x_L and x_U, respectively, to a transformation and outputs the transformed output image Y. (emphasis added)
>
> [0038] The calculation of the mean brightness value x_m by the unit 1 will be explained below, with FIG. 3 illustrating one possible realization of this mean value calculating unit 1.
>
> [0039] In the calculation of the mean value, a distinction is made between a spatial mean value and a temporal mean value. The spatial mean value is calculated for each input image X by the input image being subjected to low-pass filtering and then subsampled by the factor 8. This is done twice in accordance with FIG. 3, two low-pass filters 5, 7 and two subsampling devices 6, 8 being provided for this purpose. This procedure reduces the number of pixels overall by the factor 64. From the pixels that have thus remained, a quantized histogram is calculated with the aid of a corresponding unit 9 (i.e., the unit 9 determines a quantized brightness distribution of the reduced input image). In this case, the unit 9 uses the following quantized density function $p_Q(x_q)$, where x_q denotes the different quantized brightness values and q denotes the number of the respective quantization level, and it is assumed that each quantization level comprises 32 brightness values x_k. (emphasis added)
>
> $$\sum_{1=32*q}^{(q+1)*32-1} p(x_1)$$

[0040] FIG. 4A represents an example of a corresponding quantized histogram for the case of 8-bit resolution with 256 different brightness values (L=256) and eight different quantization levels (q=0, 1 . . . 7).

[0041] The quantized histogram is then used to calculate the spatial mean value in accordance with the formula $x_m(T)=q_{max}*32+16$ (or generally $x_m(T)=q_{max}*(L/q)+L/(2q)$). In this case, q_{max} denotes that quantization level which has the bar having the maximum value in the quantized histogram. Consequently, $q_{max}=2$ in the exemplary quantized histogram shown in FIG. 4A, with the result that the value 80 is produced for the spatial mean value $x_m(T)$. By contrast, if a plurality of bars have the maximum value, the rounded-down mean value of the numbers of the corresponding quantization levels is used to calculate $x_m(T)$ (i.e., in the example shown in FIG. 4B, the value INT((2+5)/2)=3 is used as q_{max} in the above-described formula for $x_m(T)$). (emphasis added)

[0042] As is shown in FIG. 3, after the determination of the spatial mean value $x_m(T)$, an offset value Off is calculated by comparing the spatial mean value with the temporal mean value of the preceding image. For this purpose, a corresponding unit 10 is provided, which, as a function of the spatial mean value $x_m(T)$ of the instantaneous image and the temporal mean value $x^T_m(T-1)$ of the preceding image, chooses the offset value Off in such a way that $x_m=x^T_m(T)=- x^T_m(T-1)+Off$ holds true. In this case, the unit 10 selects the offset value Off from a set {-OFFSET, . . . , -1, 0, 1, . . . , OFFSET}, the parameter OFFSET being freely programmable and being chosen such that the temporal mean value always moves in the direction of the present spatial mean value. In particular, OFFSET=1 may be chosen, so that only the values -1, 0 and 1 are considered for the offset value Off. In this way, the newly calculated temporal (and spatial) mean value $X^T_m(T)$ of the instantaneous image is output as the desired mean brightness value x_m. (emphasis added)

That is, Schu teaches enhancing the contrast of an image by: a) determining a mean brightness value of the individual pixels of the image; b) processing the brightness values of those pixels of the image that have a brightness less than or equal to the mean brightness value, in accordance with a first transformation function; c) processing the brightness values of those pixels of the image that have a brightness greater than the mean brightness value, in accordance with a second transformation function; and d) outputting the pixels having the brightness values processed in steps b) and c), respectively, in the form of a transformed output image, wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image.

It is respectfully submitted that, in contrast, independent claim 1 of the present invention reconfigures the distribution of the pixel values of the respective pixels based on the preset luminance limit values and sets a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values.

Anticipation requires a lack of novelty of the invention as claimed. The invention must have been known to the art in the detail of the claim; that is, all of the elements and limitations of the claim must be shown in a single prior reference, arranged as in the claim. See C.R. Bard, Inc. v. M3 Systems, Inc., 157 F3d 1340, 1349, 48 USPQ2d 1225, 1229-30 (Fed. Cir. 1998); Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

It is respectfully submitted that, as described above, the method and circuit arrangement of Schu are different from the apparatus, method and computer-readable medium of the present invention. Thus, it is respectfully submitted that claim 1 of the present invention is not anticipated under 35 U.S.C. §102(b) by Schu (US 2002/0136464). Since claims 2-3 depend from claim 1 of the present invention, claims 2-3 are not anticipated under 35 U.S.C. §102(b) by Schu (US 2002/0136464) for at least the reasons claim 1 is not anticipated under 35 U.S.C. §102(b) by Schu (US 2002/0136464).

B. In the Office Action, at pages 5-6, numbered paragraph 8, claims 8, 9, 14, 15 and 19 were rejected under 35 U.S.C. §102(e) as being anticipated by Goldstein (USPN 6,504,954; hereafter, Goldstein). This rejection is traversed and reconsideration is requested.

Independent claim 1 of Goldstein, the only independent claim therein, recites:

> 1. A real-time system for converting a digital input signal into a digital output signal having a specified coarse histogram, comprising: a signal processor that transforms the digital input signal into a digital output signal using a predetermined transfer function with a set of breakpoint and gain values, and which signal processor collects a coarse histogram of the generated output signal, wherein the predetermined transfer function comprises a piecewise-linear transfer function which is implemented using logic comprising a plurality of window comparators and a plurality of logic gates coupled to the plurality of window comparators, and a serially coupled subtractor, multiplier, and adder for combining signals output by the plurality of logic gates with the input signal, to generate an output signal having the specified coarse histogram; and a controller coupled to the signal processor that computes new breakpoint and gain values using a closed-loop algorithm, such that the collected coarse histogram is driven towards the specified coarse histogram.
> (emphasis added)

Thus, Goldstein teaches transforming the digital input signal into a digital output signal using a predetermined transfer function (a piecewise-linear transfer function which is

implemented using logic comprising a plurality of window comparators and a plurality of logic gates coupled to the plurality of window comparators) with a set of breakpoint and gain values, collecting a coarse histogram of the generated output signal, and using a serially coupled subtractor, multiplier, and adder for combining signals output by the plurality of logic gates with the input signal, generating an output signal having the specified coarse histogram, computing new breakpoint and gain values using a closed-loop algorithm, such that the collected coarse histogram is driven towards the specified coarse histogram.

In contrast, the present invention, as set forth in independent claims 8, 14, and 19, respectively, calculates pixel values of an image signal, limits the calculated pixel values based on pre-set luminance limit values, re-configures the calculated pixel values of the image signal; calculates a cumulative distribution function to reconfigure the calculated pixel values, and sets the contrast of the image signal based on the cumulative distribution function.

As noted above, anticipation requires a lack of novelty of the invention as claimed. The invention must have been known to the art in the detail of the claim; that is, all of the elements and limitations of the claim must be shown in a single prior reference, arranged as in the claim. See C.R. Bard, Inc. v. M3 Systems, Inc., 157 F3d 1340, 1349, 48 USPQ2d 1225, 1229-30 (Fed. Cir. 1998); Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Thus, it is respectfully submitted that independent claims 8, 14 and 19 of the present invention are not anticipated under 35 U.S.C. §102(e) by Goldstein (USPN 6,504,954). Since claims 9 and 15 depend from claims 8 and 14, respectively, claims 9 and 15 are not anticipated under 35 U.S.C. §102(e) by Goldstein (USPN 6,504,954) for at least the reasons claims 8 and 14 are not anticipated under 35 U.S.C. §102(e) by Goldstein (USPN 6,504,954).

REJECTION UNDER 35 U.S.C. §103:

A. In the Office Action, at pages 7-8, numbered paragraph 10, claims 4-5 were rejected under 35 U.S.C. §103(a) as being unpatentable over Schu (US 2002/0136464; hereafter, Schu) in view of Kobayashi et al. (USPN 7,012,625; hereafter, Kobayashi). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted above, Schu teaches enhancing the contrast of an image by determining a mean brightness value of the individual pixels of the image, processing the brightness values of those pixels of the image that have a brightness less than or equal to the mean brightness value

in accordance with a first transformation function, processing the brightness values of those pixels of the image that have a brightness greater than the mean brightness value in accordance with a second transformation function, and outputting the pixels having the brightness values processed in accordance with the first and second transformation functions, respectively, in the form of a transformed output image, wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image.

Hence, Schu fails to teach or suggest reconfiguring the distribution of the pixel values of the respective pixels based on the preset luminance limit values and setting a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values, as is disclosed in independent claim 1 of the present invention.

Thus, Schu teaches away from claim 1 of the present invention.

In addition, the Examiner admits: "Schu fails to disclose a first buffer having an input terminal from which an image signal is inputted, and an output terminal connected to an output terminal of the first comparison part; a first storage to store a first setting value; and a first comparator to compare the image signal with the first setting value of the first storage, and a second buffer having an input terminal to receive output from the first comparison part, and an output terminal connected to an output terminal of the second comparison part; a second storage to store a second setting value; and a second comparator to compare the output from the first comparison part with the second setting value of the second storage."

The Examiner submits that Kobayachi teaches a first buffer and a first storage to store a first setting value and, in addition, a second buffer and a second storage to store a second setting value so that the second setting value is outputted from the pixel value limit unit. Kobayachi teaches an image quality correcting circuit that utilizes a luminance levels occurrence frequency counter for counting the occurrence frequencies of plural luminance levels sampled from video signals inputted to a video signal input terminal, a linear interpolator for generating a correcting characteristic line by making linear interpolation based on output points of counted values of the occurrence frequency counter, an image quality corrector for correcting the inputted video signals according to correcting characteristic points, a plurality of discriminators for determining the occurrence frequencies of plural luminance levels for every predetermined level, a plurality of first counters for counting the occurrence frequencies for every predetermined level discriminated by

the discriminators, a plurality of comparators for comparing the outputs of the first counters with reference values for comparison outputted from a reference value for a comparison input terminal to clear the first counters by the outputs for comparison and a plurality of second counters for counting the outputs of the comparators. However, Kobayachi fails to teach or suggest reconfiguring the distribution of the pixel values of the respective pixels based on the preset luminance limit values and setting a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values, as is disclosed in independent claim 1 of the present invention.

Thus, Kobayashi teaches away from claim 1 of the present invention.

Further, in Ruiz and Foundation v. A.B. Chance Company, 69 USPQ2d 1690 (CAFC January 29, 2004), the court held:

In making the assessment of differences, section 103 specifically requires consideration of the claimed invention "as a whole." Inventions typically are new combinations of existing principles or features. Envtl. Designs, Ltd. v. Union Oil Co., 713 F.2d 693, 698 (Fed. Cir. 1983) (noting that "virtually all [inventions] are combinations of old elements."). The "as a whole" instruction in title 35 prevents evaluation of the invention part by part. Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result – often the very definition of invention.

Section 103 precludes this hindsight discounting of the value of new combinations by requiring assessment of the invention as a whole. This court has provided further assurance of an "as a whole" assessment of the invention under § 103 by requiring a showing that an artisan of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would select the various elements from the prior art and combine them in the claimed manner. In other words, the examiner or court must show some suggestion or motivation, before the invention itself, to make the new combination. See In re Rouffet, 149 F.3d 1350, 1355-56 (Fed. Cir. 1998).

Since Schu and Kobayashi both teach away from claim 1 of the present invention, it is respectfully submitted that claim 1 of the present invention is patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kobayashi et al. (USPN 7,012,625), alone or in combination. Since claims 4 and 5 depend from claim 1 of the present invention, claims 4 and 5

are patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kobayashi et al. (USPN 7,012,625), alone or in combination, for at least the reasons claim 1 is patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kobayashi et al. (USPN 7,012,625), alone or in combination.

B. In the Office Action, at pages 8-9, numbered paragraph 11, claim 7 was rejected under 35 U.S.C. §103(a) as being unpatentable over Schu (US 2002/0136464; hereafter, Schu) in view of Kuo et al. (USPN 5,982,926; hereafter, Kuo). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted above, Schu teaches enhancing the contrast of an image by determining a mean brightness value of the individual pixels of the image, processing the brightness values of those pixels of the image that have a brightness less than or equal to the mean brightness value in accordance with a first transformation function, processing the brightness values of those pixels of the image that have a brightness greater than the mean brightness value in accordance with a second transformation function, and outputting the pixels having the brightness values processed in accordance with the first and second transformation functions, respectively, in the form of a transformed output image, wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image.

Hence, Schu fails to teach or suggest reconfiguring the distribution of the pixel values of the respective pixels based on the preset luminance limit values and setting a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values, as is disclosed in independent claim 1 of the present invention.

Thus, Schu teaches away from claim 1 of the present invention.

Kuo teaches <u>enhancing a color image</u> using a video processing system equipped to represent a dynamic range of intensity values and a dynamic range of saturation values by <u>representing the color image by a plurality of pixels in $YC_r C_b$ (luminance and chrominance) color space</u>, the color image having a finite range of luminance values and a finite range of chrominance values, <u>applying a first transformation function to the finite range of luminance values and a second transformation function to the finite range of chrominance values</u>, the first

transformation function transforming the first finite range of luminance values to correspond to the entire dynamic range of luminance values, and the second transformation function transforming the finite range of chrominance values to correspond to the entire dynamic range of chrominance values, the first and second transformation functions providing an enhanced image having fully optimized luminance and chrominance values without converting a color image from $YC_r C_b$ color space to another color space, wherein the first transformation function is a piece wise linear mapping function in two dimensions having three substantially linear regions defined by four intensity value points, the first dimension representing the finite range of luminance values, and the second dimension representing the dynamic range of luminance values, defining a first luminance value point as being represented by the minimum luminance value in the image, defining a second luminance value point as being represented by the maximum luminance value in the image, selecting third and fourth intensity value points having values in the first dimension between the first and second luminance value points, wherein the piece wise linear mapping function consists of first, second, and third line segments, the first line segment being defined by points vmin and vlower, the second line segment being defined by points vlower and vupper, and the third line segment being defined by points vupper and vmax, such that vmin is the minimum luminance value in the image, vmax is the maximum luminance value in the image, selecting vlower and vupper based upon the relative overexposure or underexposure of the image such that, if the image is relatively under-exposed, vlower is selected to be relatively close to vmin and vupper is selected to be relatively distant from vmax, thereby compressing high luminance values and expanding low luminance levels; and if the image is relatively over-exposed, vupper is selected to be relatively close to vmax, and vlower is selected to be relatively distant from vmin, thereby compressing lower luminance values and expanding higher luminance values, wherein vupper and vlower are calculated by performing the operations of developing a luminance value histogram for the image to be enhanced by dividing the range from vmin and vmax into a plurality of sub-ranges such that, for each of the plurality of sub-ranges, the number of pixels in the image having luminance values in this sub-range is calculated; the center of gravity of the luminance value histogram being defined as the first moment and being indicative as to the relative over- or under-exposure of the image, such that the first moment is relatively closer to vmin than to vmax for an underexposed image and relatively closer to vmax than to vmin for an overexposed image, and selecting vlower and vupper such that, as the first moment becomes increasingly closer to vmin, vupper increases and vlower decreases, and, as the first moment becomes increasingly closer to vmax, vupper decreases and vlower increases.

Kuo teaches utilizing the entire dynamic range of luminance values, in contrast to claim 1 of the present invention, which recites re-configuring the distribution of the pixel values of the respective pixels based on the pre-set luminance limit values. Kuo fails to teach or suggest reconfiguring the distribution of the pixel values of the respective pixels based on the preset luminance limit values and setting a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values, as is disclosed in independent claim 1 of the present invention.

Thus, Kuo teaches away from claim 1 of the present invention.

Since Schu and Kuo both teach away from claim 1 of the present invention, it is respectfully submitted that claim 1 of the present invention is patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kuo et al. (USPN 5,982,926), alone or in combination. Since claim 7 depends from claim 1 of the present invention, claim 7 is patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kuo et al. (USPN 5,982,926), alone or in combination, for at least the reasons claim 1 is patentable under 35 U.S.C. §103(a) over Schu (US 2002/0136464) in view of Kuo et al. (USPN 5,982,926), alone or in combination.

C. In the Office Action, at pages 9-10, numbered paragraph 12, claims 10 and 16 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goldstein (USPN 6,504,954; hereafter, Goldstein) in view of Quardt et al. (USPN 5,434,931; hereafter, Quardt). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted above, Goldstein teaches transforming the digital input signal into a digital output signal using a predetermined transfer function (a piecewise-linear transfer function which is implemented using logic comprising a plurality of window comparators and a plurality of logic gates coupled to the plurality of window comparators) with a set of breakpoint and gain values, collecting a coarse histogram of the generated output signal, and using a serially coupled subtractor, multiplier, and adder for combining signals output by the plurality of logic gates with the input signal, generating an output signal having the specified coarse histogram, computing new breakpoint and gain values using a closed-loop algorithm, such that the collected coarse histogram is driven towards the specified coarse histogram.

In contrast, the present invention, as set forth in independent claims 8 and 14, calculates pixel values of an image signal, limits the calculated pixel values of the respective pixels based on the preset luminance limit values, reconfigures the calculated pixel values of the image signal

and calculates a cumulative distribution function to reconfigure the calculated pixel values and sets a contrast of the image signal based on the cumulative distribution function.

Hence, Goldstein teaches away from independent claims 8 and 14 of the present invention.

Quardt teaches a picture reproduction by scanning a picture in a gray level electronic scanner, the scanner providing a set of gray scale values representative of the picture, and storing the set of gray scale values in a memory, the gray scale values having n levels, identifying a portion of the picture to be used to generate an initial histogram, where a subset of the stored set of gray scale values corresponds to the identified portion of the picture, reading the subset of the stored set of gray values from memory and building therefrom the initial histogram having a range of n elements, the range having a lowest element and a highest element, each respective element having a count of the number of gray scale values in the portion corresponding to a respective one of the n levels, reducing spikes in the initial histogram by reducing the count of a predetermined number of elements having the largest counts to the smallest count of the predetermined number of elements, determining a lower range of the initial histogram having a predetermined percentage of the total count of the subset, an upper range of the initial histogram having the predetermined percentage of the total count of the subset, and a reduced range histogram comprising elements between the lower and upper ranges, generating a composite map from a first and second mapping and storing the composite map in memory, the first mapping including: mapping elements in the lower range to the lowest range element, and mapping elements in the higher range to the highest range element, and mapping the elements in the reduced range to respective first mapped element locations throughout the range in accordance with the average density of counts of the reduced range histogram; and, the second mapping including mapping the first mapped elements to new second mapped elements throughout the range as a function of characteristics of a printer; reading the set of gray scale values from memory and transforming each gray scale value in the set in accordance with the stored composite map, dithering the transformed gray scale values, and printing the picture on the printer as a function of the dithered transformed gray scale values.

Thus, Quardt teaches picture image processing utilizing dithered transformed gray scale values, but does not teach or suggest calculating pixel values of an image signal, limiting the calculated pixel values of the respective pixels based on the preset luminance limit values, reconfiguring the calculated pixel values of the image signal and calculating a cumulative distribution function to reconfigure the calculated pixel values and setting a contrast of the image

signal based on the cumulative distribution function, as is disclosed in independent claims 8 and 14 of the present invention.

Thus, Quardt teaches away from claims 8 and 14 of the present invention.

Since Goldstein and Quardt both teach away from claims 8 and 14 of the present invention, it is respectfully submitted that claims 8 and 14 of the present invention are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931), alone or in combination. Since claims 10 and 16 depend from claims 8 and 14, respectively, of the present invention, claims 8 and 14 are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931), alone or in combination, for at least the reasons claims 8 and 14 are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931), alone or in combination.

D. In the Office Action, at pages 10-11, numbered paragraph 13, claims 11 and 17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goldstein (USPN 6,504,954; hereafter, Goldstein) in view of Quardt et al. (USPN 5,434,931; hereafter, Quardt) as applied to claims 10 and 16 above, and further in view of McCaffrey (USPN 5,949,918; hereafter, McCaffrey). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted above, it is respectfully submitted that Goldstein and Quardt teach away from independent claims 8 and 14 of the present invention. Hence, independent claims 8 and 14 of the present invention are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931), alone or in combination.

McCaffrey teaches processing an image stream to enhance a parameter of an image, said image comprising a plurality of picture elements (pixels), each of said pixels including a characteristic related to said image parameter by processing each of said pixels of said image stream according to a controllable function to produce a processed image stream, determining a statistical distribution of said pixel characteristic in said image stream, said statistical distribution representative of said parameter of said image, generating at least one function coefficient for optimizing said determined statistical distribution, and modifying said controllable function using said at least one function coefficient, wherein said controllable function is a remapping function and said at least one function coefficient is a lookup value.

Hence, McCaffrey teaches processing an image stream to enhance a parameter of the image, wherein the image stream comprises a plurality of picture elements (pixels), each of which include a characteristic related to the image parameter to be enhanced, and the pixels are processed according to a controllable function to produce a processed image stream, wherein a statistical distribution of the pixel characteristic of interest is determined, optimized and used to generate control information to modify the operation of the controllable function. McCaffrey does not teach or suggest calculating pixel values of an image signal, limiting the calculated pixel values of the respective pixels based on the preset luminance limit values, reconfiguring the calculated pixel values of the image signal and calculating a cumulative distribution function to reconfigure the calculated pixel values and setting a contrast of the image signal based on the cumulative distribution function, as is disclosed in independent claims 8 and 14 of the present invention.

McCaffrey thus teaches away from independent claims 8 and 14 of the present invention.

Thus, it is respectfully submitted that claims 8 and 14 of the present invention are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931) as applied to claims 10 and 16 above, and further in view of McCaffrey (USPN 5,949,918), alone or in combination. Since claims 11 and 17 depend, indirectly, from claims 8 and 14 of the present invention, claims 11 and 17 are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931) as applied to claims 10 and 16 above, and further in view of McCaffrey (USPN 5,949,918), alone or in combination, for at least the reasons that claims 8 and 14 are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Quardt et al. (USPN 5,434,931) as applied to claims 10 and 16 above, and further in view of McCaffrey (USPN 5,949,918), alone or in combination.

E. In the Office Action, at page 11, numbered paragraph 14, claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Goldstein (USPN 6,504,954; hereafter, Goldstein) in view of Schu (US 2002/0136464; hereafter, Schu) and Kuo et al. (USPN 5,982,926; hereafter, Kuo). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

As noted above (see **C**), it is respectfully submitted that claim 8 of the present invention is patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954).

Schu teaches enhancing the contrast of an image by determining a mean brightness value of the individual pixels of the image, processing the brightness values of those pixels of the image that have a brightness less than or equal to the mean brightness value in accordance with

a first transformation function, processing the brightness values of those pixels of the image that have a brightness greater than the mean brightness value in accordance with a second transformation function, and outputting the pixels having the brightness values processed in accordance with the first and second transformation functions, respectively, in the form of a transformed output image, wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image.

Hence, Schu fails to teach or suggest calculating pixel values of an image signal, limiting the calculated pixel values of the respective pixels based on the preset luminance limit values, reconfiguring the calculated pixel values of the image signal and calculating a cumulative distribution function to reconfigure the calculated pixel values and setting a contrast of the image signal based on the cumulative distribution function, as is disclosed in independent claim 8 of the present invention.

Thus, Schu teaches away from claim 8 of the present invention.

Kuo teaches utilizing the entire dynamic range of luminance values, in contrast to claim 8 of the present invention, which recites re-configuring the distribution of the pixel values of the respective pixels based on the pre-set luminance limit values. Kuo fails to teach or suggest calculating pixel values of an image signal, limiting the calculated pixel values of the respective pixels based on the preset luminance limit values, reconfiguring the calculated pixel values of the image signal and calculating a cumulative distribution function to reconfigure the calculated pixel values and setting a contrast of the image signal based on the cumulative distribution function, as is disclosed in independent claim 8 of the present invention.

Hence, it is respectfully submitted that claim 8 of the present invention is patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464) and Kuo et al. (USPN 5,982,926). Since claim 13 depends from claim 8 of the present invention, claim 13 is patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464) and Kuo et al. (USPN 5,982,926) for at least the reasons claim 8 of the present invention is patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464) and Kuo et al. (USPN 5,982,926).

F. In the Office Action, at pages 12-13, numbered paragraph 15, claims 20 and 21 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goldstein (USPN 6,504,954; hereafter, Goldstein) in view of Schu (US 2002/0136464; hereafter, Schu). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

Goldstein teaches transforming the digital input signal into a digital output signal using a predetermined transfer function (a piecewise-linear transfer function which is implemented using logic comprising a plurality of window comparators and a plurality of logic gates coupled to the plurality of window comparators) with a set of breakpoint and gain values, collecting a coarse histogram of the generated output signal, and using a serially coupled subtractor, multiplier, and adder for combining signals output by the plurality of logic gates with the input signal, generating an output signal having the specified coarse histogram, computing new breakpoint and gain values using a closed-loop algorithm, such that the collected coarse histogram is driven towards the specified coarse histogram.

In contrast, the present invention, as set forth in independent claim 19, sets forth a contrast compensation apparatus, comprising: a probability density function (PDF) calculation unit, to detect a pixel value of respective pixels of an input image, a Bit Under threshold Bit Over threshold (BUBO) unit, coupled to the PDF calculation unit, to set one of a first setting value and a second setting value based on the luminance degree of the respective pixels and output resulting probability functions, a cumulative distribution function (CDF) unit, coupled to the BUBO unit, to accumulate the probability functions outputted from the BUBO unit sequentially, a CDF compensation unit, coupled to the CDF unit, to reconfigure the accumulated probability functions according to a predetermined luminance adjustment that reduces an influence on a total luminance of an output image due to luminance of predetermined portions forming the output image, and a mapping unit, coupled to the CDF compensation unit and to receive the input image, to store reconfigured CDFs and map and output pixel values of the input image according to the reconfigured CDFs. Goldstein does not teach or suggest such.

Hence, Goldstein teaches away from independent claim 19 of the present invention.

Schu teaches enhancing the contrast of an image by determining a mean brightness value of the individual pixels of the image, processing the brightness values of those pixels of the image that have a brightness less than or equal to the mean brightness value in accordance with a first transformation function, processing the brightness values of those pixels of the image that have a brightness greater than the mean brightness value in accordance with a second

transformation function, and outputting the pixels having the brightness values processed in accordance with the first and second transformation functions, respectively, in the form of a transformed output image, wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image. Thus, Schu teaches utilizing first and second transform functions wherein a first straight-line function having a first variable slope factor is the first transformation function and the second transformation function is a second straight-line function having a second variable slope factor, the first slope factor of the first straight-line function and the second slope factor of the second straight-line function being determined by an analysis of the transformed output image, which is different from utilizing a cumulative distribution function and accumulated probability functions of a contrast compensation apparatus in accordance with claim 19 of the present invention.

Schu fails to teach or suggest a contrast compensation apparatus, comprising: a probability density function (PDF) calculation unit, to detect a pixel value of respective pixels of an input image, a Bit Under threshold Bit Over threshold (BUBO) unit, coupled to the PDF calculation unit, to set one of a first setting value and a second setting value based on the luminance degree of the respective pixels and output resulting probability functions, a cumulative distribution function (CDF) unit, coupled to the BUBO unit, to accumulate the probability functions outputted from the BUBO unit sequentially, a CDF compensation unit, coupled to the CDF unit, to reconfigure the accumulated probability functions according to a predetermined luminance adjustment that reduces an influence on a total luminance of an output image due to luminance of predetermined portions forming the output image, and a mapping unit, coupled to the CDF compensation unit and to receive the input image, to store reconfigured CDFs and map and output pixel values of the input image according to the reconfigured CDFs, as is recited in independent claim 19 of the present invention.

Thus, Schu teaches away from claim 19 of the present invention.

Hence, it is respectfully submitted that claim 19 of the present invention is patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464). Since claims 10 and 21 depend, directly or indirectly, from claim 19 of the present invention, claims 20 and 21 are patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464) for at least the reasons claim 19 of the present invention is

patentable under 35 U.S.C. §103(a) over Goldstein (USPN 6,504,954) in view of Schu (US 2002/0136464).

ALLOWABLE SUBJECT MATTER:

A. In the Office Action, at page 14, numbered paragraph 16, claims 6 and 12 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants thank the Examiner for his careful review of the claims. However, in view of the above arguments, it is respectfully submitted that claims 6 and 12 are allowable in their present form.

B. In the Office Action, at page 14, numbered paragraph 17, the Examiner submitted that claim 18 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, first paragraph, set forth in the present Office Action and to include all of the limitations of the base claim and any intervening claims.

Paragraph [0064] has been amended to include the features of claim 14. New paragraph [0065] is original paragraph [0064]. Claim 18 has been amended to include the features of claim 14. Hence, claim 18 is now submitted to be in allowable form in accordance with the Examiner's suggestion. Applicants thank the Examiner for his careful review of said claim.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot, and further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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